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California Forest & Range Experiment Station

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June 21, 1938

TESTS ON THE USE OF COMPRESSED AIR IN FIRE SUPPRESSION

By

C. Lorenzen, Jr.

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
Berkeley, California

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1/ Formerly Junior Engineer with the California Station.

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TESTS ON THE USE OF COMPRESSED AIR IN FIRE SUPPRESSION

By

C. Lorenzen, Jr.[1/]

The use of compressed air in fire suppression has been suggested to control backfire, to remove litter in fire line construction, and to increase the efficiency of water. At the Spokane fire equipment conference (1936) this subject was assigned to the California Region for investigation.

A few preliminary tests served to demonstrate the impracticability of using compressed air for the rapid removal of forest litter in fire line construction. The remaining tests were concerned with the use of air-water nozzles for fire suppression.

After some experimenting a nozzle embodying a mixing chamber was developed by F. C. Lindsay[2/] for obtaining different air-water ratios. Water pressure was kept constant at 30-40 pounds. The water flow rate was varied by adjustment of a regulating valve in the line.

To test the efficiency of the nozzle at various air-water ratios, seventeen small fires, averaging from 10 to 15 feet in diameter, were burned in fairly clear plots of ponderosa pine litter. The fires were set under conditions of little or no wind and were allowed to spread to a predetermined size. The rate of suppression with the nozzle was then measured, the time to knock down the flame and to completely mop up the smouldering litter

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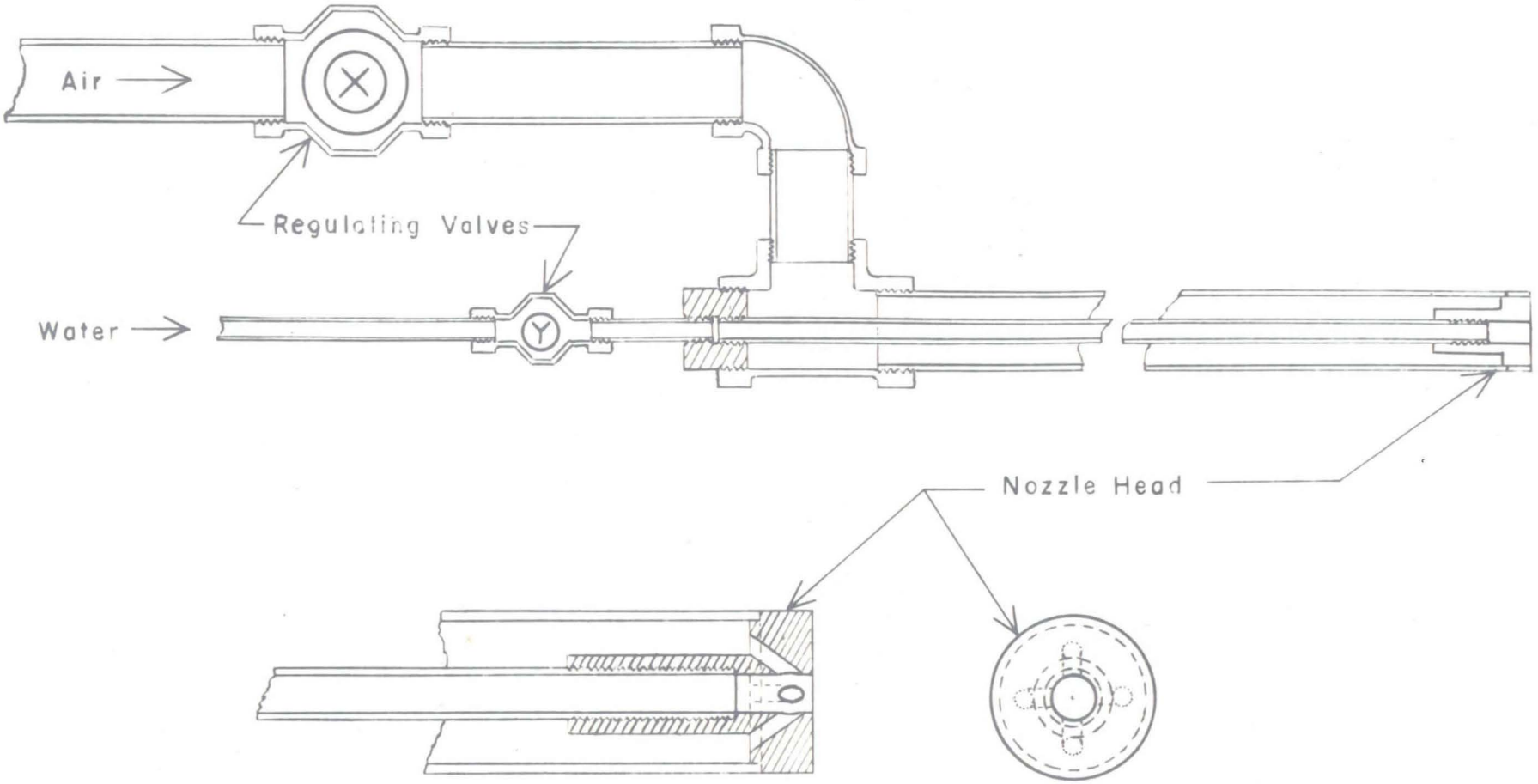

FIG. 1 AIR—WATER NOZZLE.

being recorded. Water for the tests was supplied from a 450-gallon tank truck and air was obtained from a portable compressor. Water pressure of 30-40 pounds per square inch gage was held constant throughout this series of tests, and water flow rates over the calibrated range were used at air pressures of 25 and 50 pounds per square inch.

The data obtained in these tests (fig. 2), show that there exists a very definite optimum value of water rate for a given air pressure. For higher air-water ratios (above this region) the effectiveness of the nozzle drops rapidly, while for lower ratios there is a rapidly increasing waste of water. The curves show the optimum occurring at a water rate of about 1-3/4 gallons per minute for an air pressure of 25 pounds per square inch. The curves for air pressures of 50 and 100 pounds per square inch were of similar shape. For these rates the data indicate that any air pressure above 50 pounds per square inch is undesirable.

Comparison of the action of the air-water nozzle with that of the conventional water spray nozzle was obtained on six additional ponderosa pine test fires. In each test a plot was measured, divided into two equal areas, and burned off. The separate methods were then applied to the two areas and the total mop-up times recorded. The water rates for both methods were equal in each case, giving a direct indication of the effect of the addition of air to the water. The time difference in each test was too small, compared to the total suppression time, to indicate any superiority for the air-water nozzle. Similar suppression time tests on six-foot

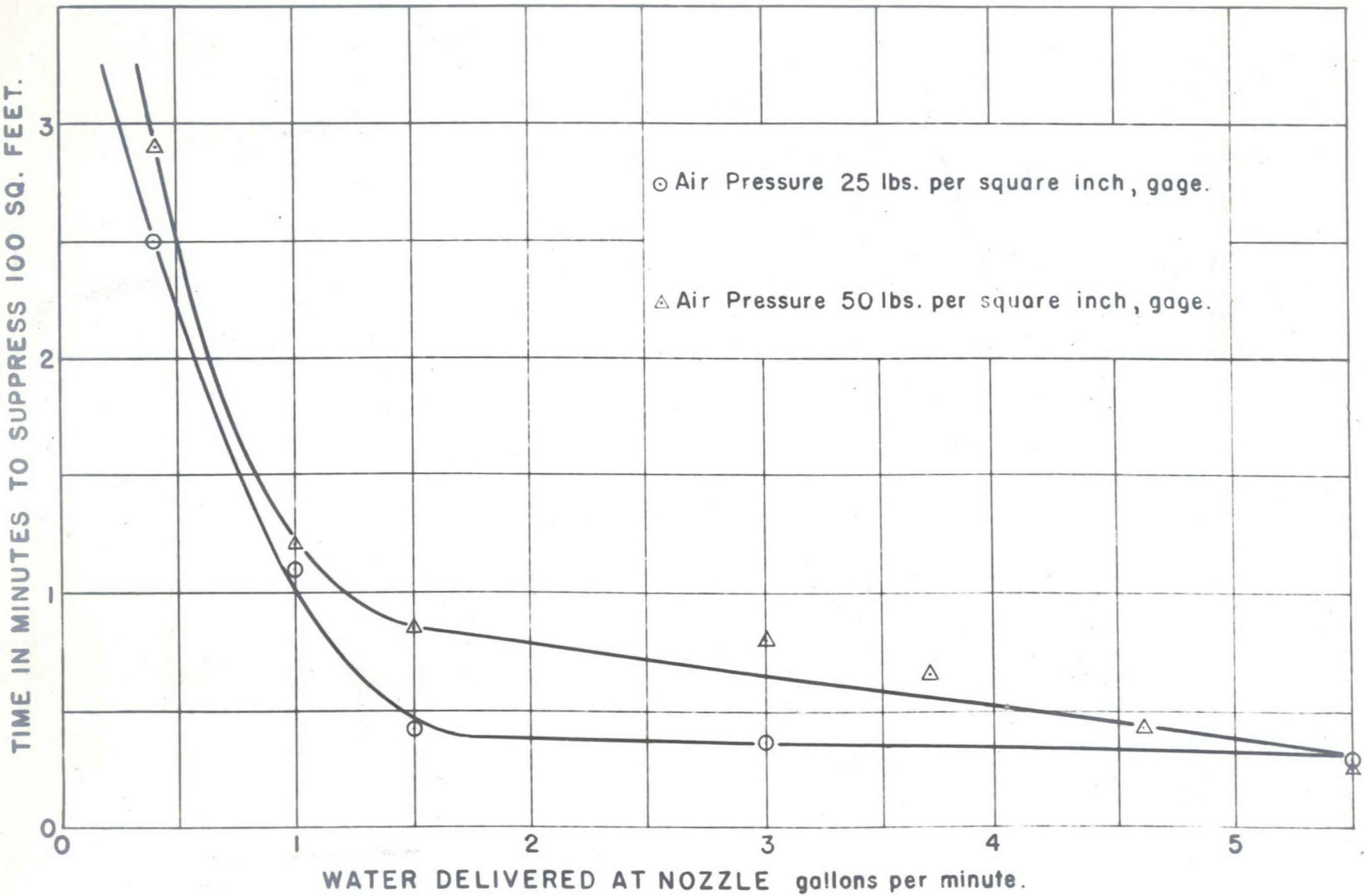

FIG. 2 AIR – WATER RATIO EFFICIENCY.

sections of burning logs showed no appreciable time difference between the use of water spray and air-water nozzles.

Although the tests showed that the air-water nozzle was not superior to the water spray nozzle for fire suppression, two valuable suggestions were obtained. First, the optimum air-water ratios found suggest that optimum flow rates and nozzle types for given water pressures could be determined by similar experiments for water spray nozzles. Second, while the additional oxygen supplied the fire by compressed air is a disadvantage the force added increases the penetrating power of the stream without increased water consumption. It would therefor appear desirable to test the use of CO_2 gas under pressure in lieu of compressed air.